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الجامعة الأردنيــة
كلية الدراسات العليا

التاريـــخ: ٢٩/ ١٢/ ٢٠١١

نموذج رقم (١٨)
اقرار والتزام بقوانين الجامعة الأردنية وأنظمتها وتعليماتها لطلبة الماجستير

أنا الطالب: نانسي عبد الرزاق محمد دقدوق الرقم الجامعي: ٨١٩٠٥٤٥

التخصص: تغذية الانسان والحميات الكلية: الزراعة

اعلن بأنني قد التزمت بقوانين الجامعة الأردنية وأنظمتها وتعليماتها وقراراتها السارية المفعول المتعلقة باعداد رسائل الماجستير والدكتوراة عندما قمت شخصيا" باعداد رسالتي / اطروحتي بعنوان: ....

comparison of the nutritional status of an elderly group in nursing homes with a group of free-living elderly in Damascus.

وذلك بما ينسجم مع الأمانة العلمية المتعارف عليها في كتابة الرسائل والأطاريح العلمية. كما أنني أعلن بأن رسالتي /اطروحتي هذه غير منقولة أو مستلة من رسائل أو أطاريح أو كتب أو أبحاث أو أي منشورات علمية تم نشرها أو تخزينها في أي وسيلة اعلامية، وتأسيسا" على ما تقدم فانني أتحمل المسؤولية بأنواعها كافة فيما لو تبين غير ذلك بما فيه حق مجلس العمداء في الجامعة الأردنية بالغاء قرار منحي الدرجة العلمية التي حصلت عليها وسحب شهادة التخرج مني بعد صدورها دون أن يكون لي أي حق في التظلم أو الاعتراض أو الطعن بأي صورة كانت في القرار الصادر عن مجلس العمداء بهذا الصدد.

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تعتمد كلية الدراسات العليا
هذه النسخة من الرسالــة
التوقيع .... التاريخ ٢/١/١٢

COMPARISON OF THE NUTRITIONAL STATUS OF AN ELDERLY GROUP IN NURSING HOMES WITH A GROUP OF FREE-LIVING ELDERLY IN DAMASCUS

By
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This Thesis was Submitted in Partial Fulfillment of the Requirements for the Master's Degree of Science in Nutrition and Food Technology

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Committee Decision

This thesis (A study of the Comparison Of The Nutritional Status Of An Elderly Group In Nursing Homes With A Group Of Free-Living Elderly In Damascus) was successfully defended and approved on December 21,2011.

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الإهداء

علمتُ دائماً أنَّ التَّوفيق بابٌ مفتاحه رضا الوالدين, اللذين حدَبا عليَّ كطائر يرعى فراخه بحبٍّ وعطفٍ حتَّى تقوى وتطير وتحوِّم في السماء لترسم بالخطِّ الواضح الجليّ قوله تعالى.

"ربِّ ارحمهما كما ربّياني صغيراً".

♥ إلى **والدي** الذي أظلني بحَدبٍ وحنوٍّ لا نظير له.....
ومنحني كُلَّ الحب والرعاية .....
فأمسك بيدي وحثني على البحث وطَلَبِ العلم وملأَ قلبي سعادة ببسمة الرضا التي لا تفارق وجههُ الحنون....
إلى عرّابي الذي شقّ لي الطريق وأنار لي الدرب ......

♥ إلى **والدتي** الطيبة النقية....
التي سارت معي...
وخففت من تعبي ....
ومسحت على جبيني بكل الحنان وغمرتني بكل الحب ...
ففاض قلبي حباً لها وشكراً لرعايتها ...

♥ إلى **إخوتي** الذين أراهم في حياتي أُنسَها وفرحها وروعتها,وزرعتُهم في فؤادي:**مايا ,وسلطان,وسفيان**,وروداً مفتَّحةً ينتشر عبقها في عمري.....

♥ إلى ابنة أختي **رند**..حبّة القلب...... وبهجة الروح.......

♥ إلى إخوة لم تلدهم أمي ......
إلى من كانوا عونا لي مخلصين أوفياء.
إلى من رافقوني دربي وشاركوني أحلى الذكريات ,
أصدقائي.....

أهدي هذا البحث...........

شكر وعرفان

بسم الله الرحمن الرحيم

"إِلَيْهِ يَصْعَدُ الْكَلِمُ الطَّيِّبُ وَالْعَمَلُ الصَّالِحُ يَرْفَعُهُ"

صدق الله العظيم

ينساب الشكر من القلب كقطرات الندى , تتساقاه الزهور بسكينة وجلال وجمال....

* الشكر لله عزّ وجلَّ الذي هيّأ لي الخير والعلم أنهله كي أرى الطريق ....

* الحبُّ لوطني سوريّة؛ أرض الخير والخصب الواعد بالعطاء والإبداع.....

* الشكر إلى تلك اليد التي رعتني طالبة وباحثة، فأرشدتني إذا ما ضللت، ووجهتني إذا ما خرجت عن الطريق. كل الشكر إلى المربي الفاضل **الأستاذ الدكتور أحمد الفقيه** الذي رعى هذا البحث بحنوِّ الأب، وعلم العالم الصادق.

* الشكر للجنة المُناقِشة المؤلفة من الأستاذ الدكتور خضر المصري, الدكتورة ريما مشعل والدكتورة هبة بوادي على ما بذلوه من جهود لا تقدَّر بكلام......

* و أخص بالشكر الجزيل للدكتورة الفاضلة ريما مشعل التي أظلتني بمعرفتها،ولم تبخل عليّ بنصائحَ سدّدتْ طريق بحثي،وهدتْني السبيل القويم،ونفعتني أيَّما منفعة...

* والشكر الوافر المفعم بالوفاء والثّناء لِدُور المسنين وقاطنيها الذين منحوني حبَّهم ووقتهم ولطفهم وعصارة تجربتهم...أظلَّلهم الله بظلِّ رحمته

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List of Abbreviations

%	Percentage
B12	Vitamin B12
BMI	Body Mass Index
CBC	Complete Blood Count
CC	Calf Circumference
CDC	The Center for Disease Control and Prevention
CHD	Coronary Heart Diseases
Cm	Centimetre
DHHS	Department of Health and Human Services
Dl	decilitre
FBG	Fasting Blood Glucose
fL	Femtoliters
G	Gram
Hb	Hemoglobin
HDL	High density lipoprotein
Ht	Height
Kg	Kilogram
LDL	Low density lipoprotein
m^2	Meter square
MAC	Mid Arm Circumference
Mcg	Micro-gram
MCH	Mean corpuscular hemoglobin
MCV	Mean corpuscular volume
mg	Milligram
MNA	Mini Nutritional Assessment
n	Number of subjects
ng	Nano-gram
NIH	National Institute of Health
pg	Pico-gram
RBC	Red Blood Cell Count
TC	Total Cholesterol
TG	Triglycerides
US	United State
WBC	Weight Blood cell count
WHO	World Health Organization
Wt	Weight

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ABSTRACT

The purpose of this study was to compare the nutritional status of a group of older adults aged 60-85 years in nursing homes with a group of free living older adults in Damascus. Anthropometric measurements, biochemical tests, and Mini Nutritional Assessment scale (MNA) were used for the nutritional assessment of 100 participants divided into two groups: 50 from nursing homes and 50 living freely. The subjects comprised a cross-sectional convenient sample with equal ratio between males and females from each group.

The body weight status as evaluated by BMI showed that the proportion of underweight subjects in nursing homes (6%) was significantly higher than that in free living subjects (2%). A similar but less marked pattern was observed for the proportion of overweight subjects in nursing homes compared to free-living subject, 48% vs. 36%, respectively. Conversely, the proportion of obesity (48%) in free living subjects was significantly higher than that in nursing homes subjects (28%) ($P<0.05$). When the proportions of overweight and obesity were combined, the difference between free living subjects (84%) and subjects living in nursing homes (76%) was less marked.

Vitamin B12 deficiency (serum B12 <200 pg/dL) was not detected (0%) in subjects living in nursing homes compared to a prevalence of 16% in free living subjects. Based on high MCV size, true B12 deficiency may be present in 4% of free-living subjects. Conversely, low serum albumin (<3.5mg/dL) was not detected in any of the subjects living at home compared to a low prevalence of 8% in subjects at nursing homes.

Based on fasting blood glucose, diabetes was more prevalent, 28% in nursing-home subjects compared to a prevalence of 18% in subjects living at home. Conversely, 30% of free living subjects were pre-diabetic compared to 18% of nursing homes subjects.

The proportion of free-living subjects with high total cholesterol levels (>240 mg/dL) was significantly higher, 24%, compared to a prevalence of 12% in nursing-home subjects ($P<0.05$). Border-line cholesterol level (200-239 mg/dL) tended to be

more prevalent in free living subjects (32%) compared to a prevalence of 20% in nursing-home subjects (P<0.05).

The proportion of free-living subjects with high triglyceride level (>200 mg/dL) was significantly higher, (46%), compared to a prevalence of 34% in nursing-home subjects (P<0.05). Border-line triglyceride levels (150-199mg/dL) were more prevalent (30%) in free living subjects compared to a prevalence of (20%) in nursing-home subjects.

About half of older adults living in nursing homes had a better normal level of TG (<150mg/dL) (46%), compared to (24%) of free living subjects (P<0.05). Similarly, about two-third of older adults in nursing homes enjoyed a significantly normal level of total cholesterol (<200mg/dL) (P<0.05).

Regarding anemia as indicated by hemoglobin level (<14 mg for males, <12 mg for females) 16% of nursing homes subjects were anemic, compared to 6% of free living subjects (P<0.05.). Based on low MCV size, 4% of nursing homes subjects may be considered having iron deficiency anemia (IDA), compared to a prevalence of 6% in free-living subjects.

A higher proportion of subjects who live freely (64%) drink > 5 but < 8 cups of fluid per day compared to 36% of subjects living in nursing homes (P<0.05).

Based on MNA score, only few subjects (6%) in nursing homes were well nourished compared to all subjects (100%) living at home (P<0.05). Further, about 92% of subjects living in nursing homes were at risk of malnutrition with only one subject scored as malnourished (P<0.05). Almost all older adults living in nursing-homes (96%) were suffering from psychological stress with only (6%) of free-living subjects (P<0.05).

In conclusion, older adults in nursing homes suffered from the risk of malnutrition based on MNA score with reported psychological stress in almost all of the nursing subjects. However, an apparent better control for body weight, TG, TC and vitamin B12 was enjoyed by nursing-home residents compared to free living subjects. Fluid intake was not adequate in all subjects.

Introduction

The World Health Organization (WHO) defined elderly as persons aged 60 years and older (Solomons *et al.,* 2000). In Syria elderly life expectancy rose from 56 years in 1970 to 70 years in 2000 and to 71 years in 2001. Those born today can expect to live an average of 73.1 years (Syrian Ministry of Health,2003).According to Syrian Morbidity and Mortality report, 837000 individual with 65 years and older 458000 males and 379000 females (Syrian Ministry of Health,2006).

Appropriate nutrition plays an important role in maintaining health and prevention of the danger of developing the majority of chronic diseases in the elderly (Murray and lopez, 1997). Major mortality cause is vascular disease and associated chronic conditions (Murray and lopez, 1997) which means healthy life style such as physical activity and nutritious diets should be taken in consideration to improve elderly health and increase life expectancy. Aging affects absorption, use, and excretion of nutrients and that's why older adults need special nutrient requirements (Kuczmarski and Weddle, 2005).

The Mini Nutritional Assessment (MNA) is a valid nutritional screening tool for elderly populations (Guigoz, 2006) and (Vellas *et al.,* 2006). It includes anthropometric assessment, general assessment, dietary assessment and self assessment. It is easy to administer in addition to being an inexpensive tool. It is also sensitive, specific and reproducible tool (Guigoz, 2006). MNA score of ≥24 suggests well-nourishment, 17-23.5 identifies patients at risk of malnutrition while a score of <17 suggests malnourishment.

Nutritional habits and lifestyle choices influence health across the lifespan. Maintenance and improvement of the nutritional status remain a health priority in adulthood and aging .Older people need constant attention as well as good nutrition, because they are in a critical period of their lives (Tucker and Dauffenbach, 2011). Many

older adults have special nutrient requirements because aging affects absorption, use, and metabolism. The cumulative effects of lifelong dietary habits determine the nutritional status in old age. Good nutrition throughout life contributes to optimal growth, appropriate weight, and nutrient levels in blood and other tissues that provide disease resistance. The Center for Disease Control and Prevention (CDC) suggests that genetics contributes 19% to longevity, 10% to high-quality health care, 20% to environmental factors, and 51% to lifestyle factors (Gerberding *et al*., 2005). Nutrition is an integral part of environmental and life style factors. Besides reducing the risk of disease and delaying death, diet plays a role in health and longevity by contributing to wellness and quality of life.

Studying the nutritional status of elderly is crucial in order to enhance their health status and enhance the efficiency of their medication, as well as the quality of their lives and their longevity (Krinke, 2008). Populations in developing countries as well as in developed countries are growing old. The proportion of those whose age is 60 years and above is progressively increasing. For example, in year 2009, the percentage of Damascene elderly was 7.1% of the total of population (Central Bureau of Statistics of Syria.2009) as compared to 5.7% in year 2005. In addition, life expectancy rose from 59 years in 1970 to 67 years in 1994 and to 73 years in 2008 (Shaaban, 2009). The nutrition of the elderly is a forgotten area in the Arab world in general, and Syria is not an exception. To this effect and to the best of my ability, I have not found any publications that evaluate the nutritional status of Syrians. Therefore, the aim of this study was to compare the nutritional status of an elderly group aged 60-85 years in nursing homes with a group of free-living elderly in Damascus using:

1) Anthropometric measurements including weight, height, BMI, calf circumference, mid arm circumference.

2) Biochemical tests including: complete blood count, vitamin B12, albumin, triglycerides, total cholesterol, and fasting blood glucose.

3) Mini Nutritional Assessment scale.

Literature Review

2.1. Aging

Aging is defined as a continuous process that starts at conception and continues until death (Balcombe, 2001). (Jayanthi *et al.,* 2010) defined it as those processes that increase the susceptibility of individuals, as they grow older to the factors that eventually lead to death. Gerontologists have theories about why the body ages. They grouped these theories as: Cellular, physiological, organ-based and as genetic theories of ageing (Balcombe, 2001). Factors such genetics, illness, socioeconomics, and lifestyle all play a role in how aging process affects each person (Krause's Food & Nutrition Therapy, 2010).

Life expectancy is defined as the average whole number of years that an individual expects to live (Tosato *et al*., 2007). Increasing life expectancy should proceed side by side with a disability-free life (Leveille *et al*., 1999). In order to achieve this goal, successful aging becomes a worldwide issue. Rowe and Kahn, 1998 defined life expectancy as including three key concepts: absence or avoidance of disease and risk factors related to this disease, maintenance of physical and cognitive functioning, and engagement actively with life (Rowe and Kahn, 1998).

2.1.1. Physiological Changes and Aging

Ageing is a normal biological process, as age advances however, many declines occur in physiological function. We should recognize normal declines of ageing and declines due to complications as explained below about sarcopenia, sensory problems, B12 status, serum albumin, coronary heart diseases.

2.1.2. Sarcopenia

Sarcopenia is an age related decline in lean tissue due to impairments in metabolism and protein intake (Baumgartner *et al*., 1998). As reported by Timothy, there are three consequences related to having sarcopenia: Age-related loss of strength, age-related loss of skeletal muscle mass, and age-related changes in muscle quality (Doherty, 2003). Age-related anorexia may increase the susceptibility to sarcopenia (Doherty, 2003). Losing lean tissues with excess stores of fat decrease physical activity and results in Sarcopenic Obesity (Krause's Food & Nutrition Therapy, 2010). Many studies reveal that sarcopenia is associated with functional disabilities in elderly in their homes (Janssen *et al.,* 2002) or hospitalized ones (Oskvig, 1999).

2.1.3. Sensory Problems

Many people are affected by sensory loss at different ages but to varying levels. Elderly with sensory problems have a low quality of life (Carabellese *et al*., 1993). Physical reliance in women strongly related with severe sensory impairments (Dargent-Molina *et al.,* 1996).

A 5-year follow up examination for hearing loss among older adults found that hearing loss increases with age specially for those aged between 80 to 97 (Murphy *et al.,* 2002) . Elderly who reported hearing loss inequality in health, behavior, and societal roles (Crews and Campbell, 2004). Social isolation is also common for those who are 70 year old and over (Jones *et al*., 1984).

Low quality of life is also associated in patient with low-vision (Scott *et al*., 1999**).** Age-related, cataract, glaucoma, and diabetic retinopathy are the most recognized conditions that cause elderly vision loss (Quillen, 1999). Severe vision impairments increase the risk of falling in 60% of Singapore Malay (Lamoureux *et al.,* 2008).

Dysgeusia, ageusia, and hypogeusia are terms related to taste disturbance, absence, and diminished of tasting respectively (Arcavi and Shahar, 2003) . Many studies indicate that smell and taste acquity in the elderly losses with age (De Jong *et al.,*1999) and (Bla , 1994). Food flavor enhances the senses of taste and smell are lost. Moreover, taste and smell changes cause poor appetite (De Jong *et al.*, 1999).

In addition, poor appetite and ageing decrease dietary intake (Morley and Thomas, 1997) and (Morley, 2001).

2.1.4. Aging and Vitamin B_{12} Status

Vitamin B_{12} "cobalamin" is a water soluble vitamin. Its most efficient source is fish meat, sheep meat, and chicken meat (Watanabe, 2007). Three ounces of chicken meat provide 0.25 mcg of B_{12} while 2.0 mcg of B_{12} from three ounces of ground beef. Low serum B_{12} among elderly is common. According to Clarke *et al., (2004)* study which included free-living elderly, 1 of 20 American persons aged 65-74 years and 1 of 10 aged 75 years and over has B_{12} deficiency. In institutionalized American elderly the deficiency was more prevalent (Essama-Tjani *et al.*, 2000). B_{12} deficiency is associated with cognitive problems (Hin *et al.,* 2006), Alzheimer's disease (Clarke *et al*., 1998), depression (Penninx *et al.,* 2000) and pernicious anemia (Carmel, 1996).

2.1.5. Ageing and Serum Albumin

Serum albumin values decrease with ageing (Bauıngartner *et al*., 1996). Low concentrations of serum albumin are associated with increased morbidity and mortality in hospitalized patients (Tuchschmid and Tschantz, 1992) and (Young *et al*., 1990) and in healthy elderly (Klonoff-Cohen *et al*., 1992). It can also predict death, length of stay, and readmission (Herrmann *et al*., 1992). The value of albumin as indicator of early protein depletion and repletion is poor because albumin's relatively long half-time (14-

20 days) and large body pool (4-5 g/kg of body weight) (Young *et al.*, 1990). As a result of the above albumin characteristics, serum level of albumin responsed slowly to the nutritional intervention. Normal values for albumin range from 35 to 50 g/dl (Klonoff-Cohen *et al.*, 1992)

2.1.6. Aging and Coronary Heart Disease

Coronary heart disease is highly related to the changing of lipid profile associated with ageing (Castelli *et al.*, 1977). Women with natural menopause without any hormone therapy have higher levels of low density lipoprotein (LDL) cholesterol and lower level of high density lipoprotein (HDL) compared with pre-menopause (Matthews *et al .,* 1989).According to the latest survey in Syria on non-communicable diseases, total blood cholesterol averaged 207.8 and 201.0 in elderly males and females, respectively (WHO Global Infobase, 2003). Among the factors involved in developing the coronary heart diseases are smoking, physical inactivity, and high blood cholesterol; but the worst risk factor is obesity (Eckel and Krauss, 1998).

2.1.7. Ageing and Diabetes

Insulin resistance and diabetes have become a worldwide epidemic (Seidell, 2000). Over the age of 65, diabetes affects at least 20 percent of elderly (Meneilly and Tessier, 2001).Insulin resistance is the common among obese elderly and low insulin secretion among lean elderly (Gumbiner *et al.*, 1989). Diabetic elderly are more likely to die than non diabetic elderly by 4.5 times (Croxson *et al.*, 1994). Diabetes in elderly is related to macro-and microvascular diseaces (Meneilly *et al.*, 2001).

Diabetes is related to many complications such as retinopathy, neuropathy, nephropathy, and coronary heart disease. Diabetic elderly have difficulties with walking

and doing works at home (Gregg *et al*., 2002). Many studies concluded that being diabetic elderly is related to highly fracture incidence (Nicodemus and Folsom, 2001; Schwartz *et al*., 2002; Schwartz *et al*., 2001) and cognitive Impairment (Gregg *et al*., 2000; Allen *et al*., 2004).

2.2. Anthropometric Measurements and Its Interpretation for Elderly

Malnutrition among elderly is 1% among healthy elderly, 20% among hospitalized, and 37% in institutionalized (Guigoz *et al*., 2002). 70% of elderly people by 2020 will be in developing countries (WHO Expert Committee, 1995). Special references to assess the nutritional status for elderly is needed as it is not appropriate to use anthropometric references collected from adult populations (Perissinotto *et al* .,2002).Ageing elderly have many changes in their body composition such as : decline in height as a result of problems in vertebral column, weight decline due to decrease in muscle mass, and changes in the whole body composition (WHO Expert Committee,1995).The most appropriate anthropometric measurements for elderly is height, weight, skin fold thickness, and mid-upper arm circumference(Tesedo *et al*.,2011).

2.3. MNA and Nutrition Assessment for Elderly

Nutrition assessment is defined by the US Department of Health and Human Services (DHHS, 1988) as "The measurement of indicators of dietary status and nutrition-related health status to identify the possible occurrence, nature, and extent of impaired nutritional status" (U.S. Department of Health and Human Services, 1988). Because of knowledge of the relation between health and nutrition and the ability to alter the nutritional status, using nutritional assessment to spot diet-related disease has increased (Waitzberg *et al*., 2003). After its validation, The Mini Nutritional Assessment

(MNA) is quite often used to assess the nutritional status of elderly as it "correlates with more sophisticated measurements" in addition to being "highly predictive of poor outcomes" (Morely, 2009). The MNA has two forms; Long and short (Guigoz, 2006). In our study we used the short form (MNA-SF). MNA-SF is a validated (Kaiser *et al*., 2009), reliable (Guigoz, 2006), short, and easy to administrate in clinics, nursing homes and hospitals.

MNA need no special training. It can be easily filled if you just watch the video submitted by Nestle demonstrates step-by-step directions for using the MNA in clinical practice to identify malnutrition in the elderly on MNA-elderly website (Nestle Nutrition Institution, 2011).

Materials and Methods

3.1. Design

A cross-sectional design was used to compare the nutritional status of an elderly group aged 60-85 years in Syria. A convenience sample of 100 older adults (50 free living and 50 living at nursing homes) was obtained.

3.2. General Characteristics of Sample Population

In order to recruit the subjects, four private institutions for elderly in Damascus completed the study.

In the present cross-sectional convenient study, one hundred healthy elderly participants of either sex of age 60 years old and above were examined, including fifty free living subjects and fifty nursing home subjects. The inclusion criteria of apparently healthy participants were performed by experienced physician in the institution, in which only subjects who were free of apparent neurological diseases and who were able to move, to answer the questions and to give blood samples were considered eligible to participate in this study. Furthermore, immobile participants and/ or those who were suffering from major neurological disorder were excluded.

3.3. Procedures and Methodology

3.3.1. Demographic Data

A Mini Nutritional Assessment (MNA) questionnaire that provides information on demographic data including age, gender was used. Age was calculated for the year of birth taken from the birth certificate.

MNA is a simple quick clinical scale for the evaluation of nutritional status of elderly subjects. (Lazars. *et al.*, 2006). It is the most useful tool for comprehensive geriatric assessment and it takes about 10 min to complete. It includes four parts:

1. Anthropometric indices are useful indicators for changes in body composition or for sarcopenia.
2. The general assessment also includes some risk factors for malnutrition, such as those who live alone or in nursing homes, who take more than three medications or who have pressure sores.

3. The MNA diet questions have been designed to be applicable to many categories of elderly persons living in different countries. It is designed to detect those with modified dietary intakes (who do not eat three meals a day, who eat too few vegetable, milk products, or proteins), to evaluate the appetite, and to evaluate total fluid intakes and the need for help for feeding.

4. Finally, because subjective assessment is still a good way to assess nutritional status, the MNA includes some subjective assessment of nutrition and general health.

The sum of the MNA score distinguishes between the nutritional status of the elderly as indicated below:

- Well nourished (>23.5 points)
- At risk for malnutrition (a score of 17-23.5 points)
- Malnourished (a score of <17 points).see appendix (1)

3.3.2. Anthropometric Measurements

Anthropometric measurements include Body weight using digital scale, height using stadiometer, body mass index (BMI), calf circumference and mid arm circumference (MAC).

The body mass index (BMI) is calculated based on the following equation: Wt (Kg)/Ht^2 (m^2) and the values were classified according to WHO (1998) as the following: underweight <18.5, normal (18.5-24.9), overweight (25-29.9), moderate obesity (30.0 - 34.9), severe obesity (35-39.9), and morbid obesity (≥40).

The calf circumference, in which the tape measure should be looped around the calf in plane perpendicular to the long axis of the lower leg, is significantly correlated with lean body mass in elderly (Lee and Nieman, 2010).

Midarm circumference (MAC) in which the tape is placed around the arm, perpendicular to the long axis, and the level of triceps skinfold site, provides a crude measure of fat stores and muscle mass. (Lee and Nieman, 2010).

3.4. Biochemical Analysis

3.4.1. Blood Samples

Blood samples for analysis of plasma total cholesterol, triglycerides, albumin, complete blood count, fasting glucose and vitamin B12 were obtained from study subjects after 12- 14 hours overnight fasting. Blood samples were taken between 7 and 9 am. The samples were then transported in an ice box within one hour and were analyzed in Al Khatib laboratory* in Damascus which is considered a highly qualified place for medical analysis.

3.4.2. Principle of Analysis

Two tubes of blood were used, the first tube for complete blood count (CBC). Blood aliquots were taken into vacuette K3EDTA tubes (Greiner Bio-One GmbH, Austria).

Blood samples were then mixed on roller mixer for 30 minutes, and analyzed using cell-DYN 3700 hematology analyzer (Abbott) for the following components: WBC total count, neutrophils, lymphocytes, monocytes, eosinophils, and basophiles expressed in both percentages, absolute counts, RBC total count, hemoglobin (Hb), MCV, MCH, MCHC, and platelets.

The second tube was used for analyzing glucose, cholesterol, triglycerides and albumin. Blood aliquots was transferred to vacuette LH lithium heparin tube (Greiner Bio-One GmbH, Austria), blood was then centrifuged for 15 minutes, and analyzed using the Cobas INTEGRA 500 plus from Roche. Then the same heparin tube was used to measure vitamin B12 using Roche Modular E170 and Roche vitamin B12 kit as well.

Al-Khatib laboratory is a regular participant of the external quality control program (RIQAS) organized by Randox laboratories, Ireland.

The following cut-off points were used as indicators for:

- Serum albumin: normal ranges 3.5-5 g/dl.
- Total cholesterol: normal (200mg\dl), boarder line (200-239mg\dl), high (> 240mg\dl).
- Triglycerides: normal up to 150mg\dl, boarder-line (150-199mg\dl), high (200-499mg\dl) and very high (> 500mg\dl).
- Fasting blood glucose: normal (70-99mg\dl), impaired fasting glucose (pre diabetes) (100-125mg\dl), and diabetes (>126mg\dl).
- Vitamin B12: were determined by immunoassay method. Deficient (> 200pg/ml) and normal (200-900 pg/ml), (WHO scientific group of anemia, 2004).

- Complete blood count (CBC): Hb normal (F: 12-15g/dl; M: 14-17g/dl), MCV normal (80-100 Fl), MCH normal (27-34 pg), platelets normal (150-450 × $1000m^{m3)}$, RBC count normal (3.8-5.2 Cells/uL), and WBC normal (4-11× 109/L). (WHO, 2005).

3.5. Statistical Analysis:

Statistical analysis was performed using Statistical Analysis Software (SAS, version 9.0, 2002). Group differences for categorical nutritional status were examined using Chi square test. One way ANOVA was used to analyze other continuous variables. P values of less than 0.05 were considered significant. Data was also presented as means ± standard deviation.

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Results

4.1. General Characteristics of the Study Subjects:

Study subjects included 100 older adults aged 60 to 85 years. They comprised two groups, the first group included 50 participants living in nursing-homes (25 males and 25 females), and the second group included 50 participants living freely at home with their families (25 males and 25 females). General characteristics of the study subjects according to their living place and gender are shown in Table 1. The mean age was a 71.9±8.0 year old for males living in nursing-homes and 68.1±6.1 years old for free-living males. The mean age was a 72.4±8.0 year old for females living in nursing-homes and 66.8±7.2 years old for free-living females. Mean height for nursing-home males was 170.0 cm and 169.8 cm for free-living males. The mean height was 150.2 for females living in nursing-homes and 155.6 cm for free-living females. The mean body weight was 77.2 kg for males living at nursing-homes and 82.1 kg for free-living males. The mean body weight was 63.4 kg for nursing-homes females and 77.3 kg for free-living females. The mean body mass index (BMI) was significantly higher in males living freely (31.9 kg/m^2) than those living in nursing-homes (26.7 kg/m^2). The mean BMI was not significantly different between females living freely (28.2 kg/m^2) and those living in nursing-homes (28 kg/m2).

Females living in nursing-homes recorded the lowest mean of calf circumference (34.5±5.5 cm). The CC of free-living females (39.7±5.2 cm) tended to be higher than that in nursing homes (34.5± 5.5) (P>0.05). The mean CC for males living in nursing homes was (35.80±3.3cm) compared to that of males living freely (38.4±3.7 cm). The mean midarm circumference (MAC) was 30.3± 4.1cm in males living in nursing homes while the mean MAC was 32.1±3.6 cm for males from free-living group. The mean MAC for females living in nursing-homes was 28.6±5.2 cm and females from free-living

group 33.9±5.7 cm. There were no significant differences between the groups regarding their MAC's mean.

Table (1): General characteristics of the study subjects according to their living place and gender (Means ± Standard Deviation).

Characteristics	Males (N=50)		Females (N= 50)	
	Nursing homes (n=25)	Free living (n=25)	Nursing homes (n=25)	Free living (n=25)
Age (y)	71.9 ± 8.0	68.1 ± 6.1	72.4 ± 7.9	66.8 ± 7.2
Height (Cm)	170.0 ± 9.7	169.8 ± 6.7	150.2 ± 8.4	155.6 ± 7.5
Weight (Kg)	77.2 ± 13.2	82.1 ± 14.6	63.4 ± 15.6	77.3 ± 16.5
BMI (Kg/m^2)	26.7 ± 3.7*	31.9 ± 6.4	28.0 ± 6.3	28.2 ± 4.1
MAC (cm)	30.3 ± 4.1	32.10 ± 3.6	28.6 ± 5.2	33.9 ± 5.7
CC (cm)	35.8 ± 3.26	38.4 ± 3.7	34.5 ± 5.5*	39.7 ± 5.2

BMI: Body mass index; MAC: Mid arm circumference; CC: Calf circumference
*Significant at P-value < 0.05(free living males *vs* males in nursing homes). All other characteristics were not statistically significant.

4.2. Anthropometric Measurements for the Study Subjects

As shown in Table 2, none of the males living in nursing homes was underweight compared to only one free living male. Conversely, three females living in nursing-homes were underweight with no one of the underweight males living freely. Free living males had significantly higher percentage of obesity (36%) than those living in nursing homes (16%). Similarly, free living females had significantly higher percentage of obesity (60%) than those living in nursing homes (40%).

Table (2): Evaluation of the study subjects according to anthropometric indices for the mid arm circumference, calf circumference and body weight status according to their living place and gender expressed as number and percentage.

Anthropometric indices		**Males (N=50)**				**Females (N= 50)**			
		Nursing homes (n=25)		**Free living (n=25)**		**Nursing homes (n=25)**		**Free living (n=25)**	
		n	**%**	**n**	**%**	**n**	**%**	**n**	**%**
MAC, cm (WHO)	<21	0	0	0	0	3	12	0	0
	21-22	0	0	0	0	1	4	0	0
	>22	25	100	25	100	21	84	25	100
CC, cm (WHO)	< 31	1	4	0	0	4	16 *	0	0
	≥ 31	24	96	25	100	21	84	25	100
BMI, Kg/m^2 (WHO)	**Underweight** < 18.5	0	0	1	4	3	12	0	0
	Normal 18.5 – 24.9	7	28	4	16	2	8	3	12
	Overweight 25-29.9	14	56	11	44	10	40	7	28
	Obese ≥ 30	4	16*	9	36	10	40*	15	60

MAC: Mid arm circumference; CC: Calf circumference; BMI: Body mass index; WHO: World Health Organization, 1996. *Significant at p-value < 0.05(differences between males and females in nursing homes *vs* free living).

Table (3): Evaluation of the study subjects according to anthropometric indices for the mid arm circumference, calf circumference and body weight status according to their living place and irrespective of gender expressed as number and percentage.

Anthropometric indices		Nursing homes (N=50) n	%	Free living (N=50) n	%
MAC, cm (WHO)	<21	3	6	0	0
	21-22	1	2	0	0
	>22	46	92	50	100
CC, cm (WHO)	< 31	5	10	0	0
	≥ 31	45	90	50	100
BMI, Kg/m^2 (WHO)	**Underweight** < 18.5	3	6	1	2
	Normal 18.5 – 24.9	9	18	7	14
	Overweight 25-29.9	24	56	18	44
	Obese ≥ 30	14	16*	24	48

MAC: Mid arm circumference; CC: Calf circumference; BMI: Body mass index; WHO: World Health Organization, 1996. *Significant at p-value < 0.05(differences between males and females in nursing homes *vs* free living).

4.3. Biochemical Assessment of the Nutritional Status for the study Subjects.

Males and females living in either nursing-homes or freely had no significant differences in the means of nearly all biochemical blood indices that included vitamin B12, total cholesterol, triglycerides, fasting blood glucose (Table 4). Serum albumin, however, was significantly higher in females living in nursing-homes (6.0±0.2 g/dL) compared to females living freely (4.0±0.2 g/dL).

Table (4): Mean values of vitamin B12, blood lipid profile, fasting blood glucose, and albumin and according to their living place and gender (Means ± Standard Deviation).

Biochemical Test	Mean ± SD			
	Males (N=50)		Females (N=50)	
	Nursing homes (n=25)	Free living (n=25)	Nursing homes (n=25)	Free living (n=25)
Vitamin B12 (pg/mL)	589.1 ± 247.4	397.4 ± 275.6	747.3 ± 147.9	559.5 ± 283.3
FBG (mg/dL)	120.0 ± 51.8	109.8 ± 29.9	113.2 ± 43.5	104.7 ± 26.7
TC (mg/dL)	184.8 ± 47.3	179.8 ± 40.5	212.4 ± 54.72	201.6 ± 32.9
TG (mg/dL)	202.1 ± 109.0	209.5 ± 88.9	189.6 ± 169.6	204.2 ± 99.2
Albumin(g/dL)	3.9 ± 0.2	4.0 ± 0.2	6.0 ± 0.2*	4.0 ± 0.2

FBG: Fasting blood glucose; TC: Total cholesterol; TG: Triglyceride.
* Significant at *P*-value < 0.05.

4.4. Evaluation of Vitamin B12, Blood, Lipid Profile, Fasting Blood Glucose, and Albumin

Tables 5 and 6 show the nutritional status regarding vitamin B12, total cholesterol, triglyceride, fasting blood glucose, and albumin. Normal triglyceride levels were significantly higher in males living in nursing-homes (36%) than those living freely (24%). Border-line and high triglyceride levels were not significantly different between males living in nursing-homes and those living freely. Normal triglyceride levels were significantly higher in females living in nursing-homes (55%) than those living freely (24%). Border-line triglyceride levels were not significantly different between females living in nursing-homes and those living freely. Compared to females living in nursing-homes (24%), freely living females (44%) had significantly higher triglyceride levels.

Normal total cholesterol levels were significantly higher in males living in nursing-homes (68%) than those living freely (36%). Border-line total cholesterol levels were not significantly different from males living in nursing-homes and those living freely. Compared to males living in nursing-homes (12%), freely living males had significantly

higher total cholesterol levels (32%). Normal, border-line, and high total cholesterol levels were not significantly different between females living in nursing-homes and those living freely.

About half of the subjects had normal FBG irrespective of gender or living place ($P>0.05$) (Table 4). In addition, about one third (32%) of free living males were pre-diabetic compared to 20% of males living in nursing-homes. The proportion of free-living females who were diabetic was 16%, 28% of all other groups were diabetic ($P> 0.05$).

Normal vitamin B12 levels were significantly higher in males living in nursing-homes (100%) than those living freely (76%). On the other hand, about one-fourth (24%) of free living males and 8% of free living females having low vitamin B12 ($P<0.05$) (Table 5).

Neither males nor females serum albumin levels were significantly different between subjects living in nursing-homes and those living freely.

Table (5): Evaluation of vitamin B12, blood lipid profile, fasting blood glucose, and albumin according to their living place and gender expressed as number and percentage.

Biochemical tests		Males (n=50)				Females (n=50)			
		Nursing-Homes (n=25)		Free-living (n=25)		Nursing-Homes (n=25)		Free-living (n=25)	
		n	%	n	%	n	%	n	%
Vitamin B12 (pg/ml)	Normal (200)	25	100	19	76	25	100	23	92
	Low (<200)	0	0	6	24	0	0	2	8*
TG (mg/dL)	Normal (150)	9	36*	6	24	14	55*	6	24
	Border line (150-199)	5	20	7	28	5	20	8	32
	High (200-499)	11	44	12	48	6	24	11	44*
TC (mg/dL)	Normal (200)	17	68*	9	36	17	68	13	52
	Border line (200-239)	5	20	8	32	5	20	8	32
	High (240)	3	12	8	32*	3	12	4	16
FBG (mg/dL)	Normal (70-99)	13	52	12	48	14	56	14	56
	Pre-Diabetes (100-125)	5	20	8	32	4	16	7	28
	Diabetes (126)	7	28	5	20	7	28	4	16
Albumin (mg/dL)	Low <3.5	1	4	0	0	3	12	0	0
	Normal (3.5-5)	24	96	25	100	21	84	25	100
	High >5	0	0	0	0	1	4	0	0

TG: Triglyceride; TC: Total cholesterol; FBG: Fasting blood glucose.
* Significant at *P*-value < 0.05 for blood values comparing males or females in nursing homes *vs* free living.

As shown in Table 6, the proportion of subjects living in nursing-homes (46%) with normal triglyceride levels was significantly higher than those living freely (24%) and the proportion of subjects living freely (46%) with high triglyceride levels was significantly higher than those living in nursing-homes (34%). There is no significant difference in

the proportion of subjects regarding the border-line triglyceride levels between both groups.

Normal total cholesterol levels were significantly higher in subjects living in nursing-homes (68%) than those living freely (44%). Border-line total cholesterol levels were not significantly deferent between subjects living in nursing-homes (20%) and those living freely (32%). Compared to subjects living in nursing-homes (12%), freely living subjects had significantly higher total cholesterol levels (24%).

Fasting blood glucose was normal in 54% of subjects living in nursing-home and 52% of free-living subjects. Thirty % of free-living subjects were pre-diabetic and 18% of subjects living in nursing-homes. Subjects suffering from diabetes were 28% from nursing-homes while 18% of free-living subjects had diabetes.

Normal vitamin B12 levels were significantly higher in subjects living in nursing-homes (100%) than those living freely (84%). On the other hand subjects living freely had significantly lower vitamin B12 levels (16%) than those living in nursing-homes (0%). Only 2 free-living subjects with B12 deficiency had high MCV size, suggesting that only 2 out 8 subjects had true B12 deficiency. This is based on the fact that low serum B12 deficiency is not a strong indicator by itself. Hence, true vitamin B12 deficiency may be present in only in 4% of free-living subjects. No significant difference was observed in both groups regarding serum albumin levels.

Table (6): **Evaluation of vitamin B12, blood lipid profile, fasting blood glucose, and albumin according to their living place and irrespective of gender, expressed as number and percentage.**

Biochemical test		**Nursing homes (N=50)** n	%	**Free living (N=50)** n	%
Vitamin B12 (pg/ml)	**Normal** (>200)	50	100	42	84
	Low(<200)	0	0*	8	16
TG (mg/dL)	**Normal** (<150)	23	46*	12	24
	Border line (150-199)	10	20	15	30
	High (>200)	17	34*	23	46
TC (mg/dL)	**Normal** (<200)	34	68*	22	44
	Border line (200-239)	10	20	16	32
	High (>240)	6	1*	12	24
FBG (mg/dL)	**Normal** (70-99)	27	54	26	52
	Pre-Diabetes (100-125)	9	18	15	30
	Diabetes (>126)	14	28	9	18
Albumin (mg/dL)	**Low (<3.5)**	4	8	0	0
	Normal (3.5-5)	45	90	50	100
	High (>5)	1	2	0	0

TG: Triglyceride; TC: Total cholesterol; FBG: Fasting blood glucose.
* Significant at *P*-value < 0.05, comparing free living subjects with subjects living at nursing homes, irrespective of gender.

4.5. Hematology

As shown in Table 7, hemoglobin (Hb) was low in 28% of nursing-home males and 8% in free-living males. The proportion of free-living males with normal hemoglobin (92%) was significantly higher than nursing-home males (60%). Almost all females (96 %) in each group irrespective of living place had normal hemoglobin. Almost all of the subjects had normal mean corpuscular volume for both males and females in each group irrespective of living place.

The proportion of males suffering from low red blood cell count (RBC) living in nursing homes (48%) was significantly higher than the proportion of free-living males (16%) ($P<0.05$). Males with normal RBC count living in nursing-home were 44% which is significantly less than those in free-living males (84%) ($P<0.05$).The prevalence of normal RBC count in females living freely (92%) was significantly higher than that in nursing-homes (68%) ($P<0.05$). There was no significant difference in the values of normal white blood cell count (WBC) in residents of both living places regardless of gender. Males living in nursing homes with low WBC count (20%) were significantly higher than those living freely (0%) ($P<0.05$). Almost all females and males in both living place had normal values of MCH and platelets.

Table (7): CBC profile of the study subjects according to their living place and gender expressed as number and percentage.

CBC test		Males (N=50)				Females (N=50)			
		Nursing homes (n=25)		Free living (n=25)		Nursing homes (n=25)		Free living (n=25)	
		n	%	n	%	n	%	n	%
Mean Age (y)		71.9 ± 8.0		68.1 ± 6.1		72.4 ± 7.9		66.8 ± 7.2	
Hb (g/dL)	Low	7*	28	2	8	1	4	1	4
	Normal M: 14-17 F: 12-15	15	60	23	92	24	96	24	96
	High	3	12	0	0	0	0	0	0
MCV (fL)	Low <80	2	8	1	4	1	4	2	8
	Normal (80-100)	22	88	24	88	23	92	23	88
	High >100	0	0	1	4	0	0	1	4
RBC (Cell/Ul)	Low	12	48*	4	16	8	32	2	8
	Normal	11	44	21	84*	17	68	23	92*
	High	2	8	0	0	0	0	0	0
WBC	Low	5	20*	0	0	1	4	1	4
	Normal	18	72	22	88	23	92	22	88
	High	2	8	3	12	1	4	2	8
MCH (Pg)	Normal (27-34pg)	24	96	25	100	25	100	25	100
	High >34pg	0	0	1	4	0	0	0	0
Platelets	Low	0	0	1	4	2	8	0	0
	Normal	24	96	23	92	23	92	24	96
	High	1	4	1	4	0	0	1	4

CBC: Complete blood count; Hb: Hemoglobin; MCV: Mean cell volume; RBC: Red blood cell count; WBC: White blood cell count; MCH: Mean corpuscular hemoglobin.
* Significant at *P*-value < 0.05.

As shown in Table 8, regardless the gender, it was observed that out of the 8 subjects in nursing homes who had anemia(low hemoglobin), only 2 had low MCV size suggesting

that these two subjects had iron deficiency anemia (IDA). Thus 2 out of a total of 50 older subjects (4%) had IDA. In contrast, all of the 3 subjects living at homes who had low Hb were found to have also low MCV size, suggesting that all of them had IDA. Thus the proportion of older adults who had IDA in free-living participants is 6% (3/50).

Table (8): Evaluation of CBC profile of the study subjects according to their living place and irrespective gender expressed as number and percentage .

CBC test		Nursing homes (N=50) n	%	Free living (N=50) n	%
Hb (g/dL)	Low	8*	16	3	6
	Normal M: 14-17 F: 12-15	39	78	47	94
	High	3	6	0	0
MCV (fL)	Low <81	3	6	3	6
	Normal (81-99)	45	90	47	94
	High >99	0	0	2	4
RBC (Cell/Ul)	Low<3.8	20	40*	6	12
	Normal 3.8-5.2	28	56	44	88*
	High>5.2	2	4	0	0
WBC	Low	6	12*	1	2
	Normal	41	82	44	88
	High	3	6	5	10
MCH (Pg)	Normal	49	98	50	100
	High	0	0	1	2
Platelets	Low	2	4	1	2
	Normal	47	94	47	94
	High	1	2	2	4

CBC: Complete blood count; Hb: Hemoglobin; MCV: Mean cell volume; RBC: Red blood cell count. WBC: White blood cell count; MCH: Mean corpuscular hemoglobin.
* Significant at *P*-value < 0.05.

4.6. Mini Nutritional Assessment Scale

4.6.1. Weight Loss during the Last Three Months

As shown in Table 7, almost all (92%) of nursing-home males and 96% of free-living males did not have any change in their weight during the last three months. Forty-four percent of females living in nursing-home had lost 1-3 kg from their weight in the last three months while 12% only of the females who lived freely lost 1-3 kg($P<0.05$). While 52% and 88% of females in both groups did not have any change in their weight during the last three months ($P<0.05$).

Regardless the gender, 92% of free-living older adults and 72% of nursing-home older adults did not have any change in their weight during the last three months. About one-fourth (26%) of all nursing-home participants and 6% of all free-living elderly lost 1-3 kg during the last three months (Table 9).

Table (9): Weight loss during the last three months of the study subjects according to their living place and gender expressed as number and percentage.

Weight loss	Males (N=50)				Females (N=50)			
	Nursing homes (n=25)		Free living (n=25)		Nursing homes (n=25)		Free living (n=25)	
	n	%	n	%	n	%	n	%
> 3 Kg	0	0	1	4	1	4	0	0
1-3 Kg	2	8	0	0	11	44*	3	12
No weight loss	23	92	24	96	13	52*	22	88
Total (males and females)	n	%			n	%		
	Nursing homes				Free living			
> 3 Kg	1	2			1	2		
1-3 Kg	13	26*			3	6		
No weight loss	36	72*			46	92		

*Significant at p-value < 0.05 (differences between males and females in nursing homes *vs* free living).

4.6.2. Medicinal Intake

About half of freely living subjects take more than 3 medicinal drugs a day while 72% of nursing-home males take more than 3 drugs daily. The proportion of males who took less than 3 drugs daily was 28% of males in nursing-homes compared to 44% of males who live freely. Females who take more than 3 drugs daily were 88% of females in nursing-home compared to 64% free-living females.

Regardless the gender elderly who take more than 3 drugs daily are more in nursing home (80%) than in free living (60%). While people who took less than 3 drugs daily were more in free-living (40) than in nursing home (20).

The most commonly used drugs as reported by the study sample were antidepressant, anti-diabetic drugs (insulin, hypoglycemic agents), and non-steroidal pain killers.

Table (10): Medicinal intake of the study subjects according to their living place and gender expressed as number and percentage.

Medicinal intake	Males (N=50)				Females (N=50)			
	Nursing homes (n=25)		Free living (n=25)		Nursing homes (n=25)		Free living (n=25)	
	n	%	n	%	n	%	n	%
More than 3 drugs/day	18	72	14	56	22	88*	16	64
Less than 3 drugs	7	28	11	44	3	12*	9	36
Total (males and females)	**Nursing homes**				**Free living**			
	n	%			n	%		
More than 3 drugs/day	40	80*			30	60		
Less than 3 drugs	10	20*			20	40		

*Significant at p-value < 0.05 (differences between males and females in nursing homes *vs* free living).

4.6.3. Psychological Stress

As reported by the subjects themselves, all older adults males living in nursing-homes were suffering from psychological stress compared to only 12% of males who live freely suffer from psychological stress. Females who live freely did not suffer from

any psychological stress while 92% of those who live in nursing-home had psychological stress. Regardless of gender, almost all older adults who live freely (94%) have no apparent psychological stress compared to 96% of those who live in nursing-homes.

The most commonly used drugs as reported by the study sample were antidepressant, anti-diabetic drugs (insulin, hypoglycemic agents), and non-steroidal pain killers.

Table (11): Treatment for psychological stress of the study subjects according to their living place and gender expressed as number and percentage.

Psychological stress	Males (N=50)				Females (N=50)			
	Nursing homes (n=25)		Free living (n=25)		Nursing homes (n=25)		Free living (n=25)	
	n	%	n	%	n	%	n	%
Yes	25	100*	3	12	23	92*	0	0
No	0	0	22	88	2	8*	25	100
Total (males and females)	n	%			n	%		
	Nursing homes				**Free living**			
Yes	48	96*			3	6		
No	2	4*			47	94		

*Significant at p-value < 0.05 (differences between males and females in nursing homes *vs* free living).

4.6.4. Fluid Intake

A higher proportion of males who live freely (72%) drink more than 5 cups of fluid per day compared to only half as much (36%) to males living in nursing homes (P <0.05) (Table 10).Conversely, about twice as much of males (52%) in nursing homes drink from 3-5 cups/day of fluid compared to 24% of males living at home (P<0.05).

Regardless of gender, 36% of nursing-home older adults drink more than 5 cups/day compared with 64% from free-living group (P<0.05). Half of (50%) nursing-home subjects drink from 3-5 cups/day of fluid compared with 30% from free-living participants (P<0.05) (Table 12).

Table (12): Fluid intake of the study subjects according to their living place and gender expressed as number and percentage.

Fluid intake	Males (N=50)				Females (N=50)			
	Nursing homes (n=25)		Free living (n=25)		Nursing homes (n=25)		Free living (n=25)	
	n	%	n	%	n	%	n	%
< 3 cups/day	3	12	1	4	4	16	2	8
3-5 cups/day	13	52*	6	24	12	48	9	36
>5 but less than 8 cups/day	9	36*	18	72	9	36	14	56

Total (males and females)	Nursing homes		Free living	
	n	%	n	%
< 3 cups/day	7	14	3	6
3-5 cups/day	25	50*	15	30
> 5 but less than 8 cups/day	18	36*	32	64

*Significant at p-value < 0.05 (differences between males and females in nursing homes *vs* free living).

4.6.5. Mini Nutritional Assessment Scores

In nursing homes, only few subjects (one male and two females) were well nourished compared to all subjects (100%) living at home were well nourished (P <0.05) (Table 13). Conversely, 92% of subjects living in nursing homes were at risk of malnutrition with only one subject scored as malnourished (P <0.05).

Table (13): Mini Nutritional Assessment scores of the study subjects according to their living place and gender expressed as number and percentage.

MNA Categories	Males (N=50)				Females (N=50)			
	Nursing homes (n=25)		Free living (n=25)		Nursing homes (n=25)		Free living (n=25)	
	n	%	n	%	n	%	n	%
Well-nourished	1	4	25	100	2	8	25	100
At risk for malnutrition	24	96*	0	0	22	88*	0	0
Malnourished	0	0	0	0	1	4	0	0

Total (males and females)	Nursing homes		Free living	
	n	%	n	%
Well-nourished	3	6	50	100
At risk for malnutrition	46	92*	0	0
Malnourished	1	2	0	0

*Significant at p-value < 0.05 (differences between males and females in nursing homes *vs* free living).

Discussion

Older adults are highly susceptible to malnutrition due to physical and psychological etiologies (Saletti *et al.,* 2000; Suiminen *et al.,* 2000). The aim of the current study was to compare the nutritional status between Syrian older adults living in nursing homes with freely living older adults. This comparison was based on anthropometric measurements, biochemical tests and Mini Nutritional Assessment (MNA) scale. Different factors play a role in the development of malnutrition including involuntary weight loss, loneliness, chronic illness and eventually impact of morbidity and quality of life. Older adults develop malnutrition because of inappropriate dietary intake, social deprivation and poor economic status (Saletti *et al.,* 2000; Suiminen *et al.,* 2000). Body composition usually changes with aging, even without the presence of any acute or chronic diseases (Kehayias *et al.,* 2002). Age-related weight loss may be characterized by loss of muscle mass due to a decrease in appetite and presence of gastrointestinal disturbances (Santos *et al*., 2004; Elia, 2001). A decrease in height of older adults may result from osteoporosis and kyphosis which lead to shortening in the spinal column (Lewis and Bell, 1990).

Several studies showed that older adults living freely had significantly higher prevalence of obesity (BMI > 30 kg/m^2) than those living in nursing homes (Pai, 2011; Sibai *et al*., 2003). Similar results were found in the current study where free living males and females had significantly higher percentage of obesity (36% and 60%, respectively) than those living in nursing homes males and females (16% and 40%, respectively). The prevalence of malnutrition was significantly higher in males and females living in nursing homes compared to those living freely, which is consistent with results from Pai (2011). Since unintended weight loss can reflect poor intake or changes

in the metabolism of food and nutrients, it may be the best indicator of malnutrition (Morley, *et al.*, 2004). Further, aging with decreased nutrient intake and lack of exercise would result in lower BMI and increased risk of malnutrition in older adults at nursing homes (Pai, 2011). In the current study, the higher prevalence of malnutrition in older adults living nursing homes can be explained by higher mean age of the subjects living in nursing homes besides the psychological and social problems discussed below.

In this study, only few subjects (6%) in nursing homes were well nourished compared to all subjects (100%) living at home (P<0.05). Further, about 92% of subjects living in nursing homes were at risk of malnutrition with only one subject scored as malnourished (P<0.05). This result is compatible with review published by Guigoz in (2006), it was found that prevalence of malnutrition of older adults was 1-74% and those who were at risk of malnutrition measured by MNA ranged from 8-87%.

It also could be due to the fact that malnutrition in the older adults is often associated with functional impairment, disability and impaired health. Thus, among freely living elderly the prevalence of malnutrition is generally low. Furthermore, nursing home subjects are more disabled and generally live in nursing homes because they need more care and that is why a high prevalence of malnutrition is expected more among them (Margetts *et al.*, 2003; Groot *et al.,* 2002). Furthermore, decreasing food intake among the elderly is influenced by: loneliness, social isolation and poverty. Psychological and socioeconomic problems such as depression, life events and loneliness may reduce appetite. Unfortunately, even older adults who have children have high prevalence of loneliness and malnutrition. Above all, available social and external support systems lacked the suitable quality and quantity and this condition has exacerbated their feelings of loneliness (Saeidlou *et al.,* 2011).

In the current study, it was observed that elderly who take more than 3 drugs daily are more in nursing home (80%) than in free living (60%).While people who took less than 3 drugs daily were more in free-living (40%) than in nursing home (20%).

In MNA questions, older adults taking more than three drugs per day were more malnourished than those who took less than 3 drugs daily (Saeidlou *et al.,* 2011). Multi-medicinal intake among elderly may be due to chronic diseases and poor nutrition (Saeidlou *et al.,* 2011). The cause of low food intake among elderly can be linked to both physiological and pathological factors such as pain, nausea, confusion, immobility and drug side-effects (Maliheh et al., 2008; Sheykhi, 2006) or psychosocial factors like depression and psychological stress all these factors will lead to malnutrition (Johnson, 2005). In the previous studies which use MNA, they found that many illnesses such as dementia, depression, or higher admission to nursing homes and longer length of stay in hospitals will lead to poor nutritional status (Milne *et al*., 2006; Compan *et al*., 1999). Drug consumption among the general population and particularly in older adult's population has been increased (Barat *et al.,* 2000).

In our study, high proportion of our study participants who live in nursing-homes take antidepression drugs regularly as they suffer from psychological stress. Whereas Only few of the free living older adults reported that then suffer from psychological stress. Penninx *et al.,* (1996) that found strong, linear associations between the number of chronic diseases and depressive symptoms and anxiety, indicating that psychological distress among elderly people is more apparent in the presence chronic diseases and aging,

In the current study, it was observed that subjects living freely drink more than 5 glasses of water per day (64%) compared to those living in nursing homes (36%). Food

guide pyramid (see appendix 2) was modified to compensate the needs for people over seventy years old and emphasized on the intake of fluid, nutrient dense foods and fiber (Russell *et al.,* 1999). Because of the inability of older adults to control urination they believe that they can control urination easier by minimizing their fluid intake. On the other hand, older adults are physically inactive which makes them do not feel thirsty and they can become dehydrated easily (Steinberg, 1983; Scherer, 1982).

The prevalence of normal triglycerides was significantly higher in males and females living in nursing-homes than those who live freely with their families. Thus, a high proportion of free-living males suffered from significantly higher levels of TG than all other groups. About half of older adults living in nursing homes had a better normal level of TG (46%), compared to (24%) of free living subjects ($P<0.05$). Similarly, about two-third of older adults in nursing homes enjoyed a significantly normal level of total cholesterol ($P<0.05$). It is believed that with aging blood vessel elasticity is reduced and peripheral resistance is higher with reduction of blood flow to the heart. Regular meals are given on time with added varieties of food groups to meet the needs and conditions of older adults in nursing homes. The opposite may be true for free living older adults who may not take such a variety of fruits and vegetables nor comply to any proposed modified meals that are prescribed to lower their blood TC and TG. In addition, they may not be medically taken care of by medical specialists and thus rely on home-made remedies.

In this study, it was observed that free-living males have significantly lower vitamin B12 than other groups, while all nursing-home groups have normal vitamin B12. As we mentioned early, digestion, absorption, and metabolism of older adults is impaired because of aging as well as the reduction of intrinsic factor can cause vitamin B12

deficiency. Free-living subjects who suffer from vitamin B12 deficiency reported that they were on strict vegetarian diet which is propably a strong reason for vitamin B12 deficiency. Nevertheless, we must put in our consideration that older adults with vitamin B12 deficiency will not have its classical signs and symptoms with less absorption than in younger adults. (Baik and Russell, 1999).

Forty eight percent of nursing-home males were suffering from low red blood cells (RBC) count and 28% suffer from low hemoglobin (Hb), indications of anemia. Older adults living in nursing-homes have depression, psychological stress and other contributors which clearly affect their appetite, and might lead to anemia. The effectiveness of the immune system is reduced in aging, due to reduction in immune system function especially for the T-cell component. But no significant differences or reduction in WBC count were observed in this study.

Conclusions and Recommendation

1. Conclusions: under the condition of this study

- The proportion of obesity in free living subjects (48%) was significantly higher than in nursing homes subjects (28%), (P<0.05). Free living males had significantly higher percentage of obesity (36%) than those living in nursing homes (16%). Similarly free living females had significantly higher percentage of obesity (60%) than those living in nursing homes (40%).

- A significantly high proportion of normal values for TC, TG and B12 were observed in nursing home subjects irrespective of gender with a concomitant significantly higher values for TC, TG and lower values for B12 in subjects living at home. All other values of FBG and albumin were not statistically significant.

- Regarding anemia as indicated by hemoglobin level (<14 mg for males, <12 mg for females), 16% of nursing homes subjects were anemic, as compared to 6% of free living subjects (P<0.05). Based on low serum MCV size, 4% of nursing homes subjects may be considered having iron deficiency anemia (IDA), compared to a prevalence of 6% in free-living subjects

- Regardless the gender, 92% of free-living older adults and 72%of nursing-home older adults did not have any changes in their weight during the last three months (P<0.05).About one-fourth(26%) of all nursing-home subjects and 6% of all free living older adult lost 1-3 kg in the last three months. (P<0.05).

- Older adults in nursing homes who take more than 3 medical drugs daily (80%) were significantly higher than those in free living homes (60%).

- All older adults living in nursing-homes (96%) were suffering from psychological stress and only (6%) of subjects who live freely suffer from psychological stress ($P<0.05$).

- A higher proportion of subjects who live freely (64%) drink > 5 but <8 cups of fluid per day compared to (36%) subjects living in nursing homes ($P<0.05$).

- Based on MNA score, only few subjects (6%) in nursing homes were well nourished compared to all subjects (100%) living at home ($P<0.05$). A bout 92% of subjects living in nursing homes were at risk of malnutrition with only one subject scored as malnourished. ($P<0.05$).

- In conclusion, older adults in nursing homes suffered from the risk of malnutrition based on MNA score with reported psychological stress in almost all of the nursing subjects. However, an apparent better control for body weight, TG, TC and vitamin B12 was enjoyed by nursing-home residents compared to free living subjects. Fluid intake was not adequate in all subjects.

2. Recommendations

- To reduce the risk of obesity, exercise with its different kinds endurance, resistance and weight-bearing should be practiced on regular basis.
- Body weight and status of vitamin D, osteoporosis, lipid profile and fasting blood glucose should be monitored.
- Older adults, particularly those living in nursing homes should be engaged in a variety of social activities. They need more attention and chances for having companionship with society members such as university students and members of philanthropic groups.
- In-depth studies of the elderly should be conducted to evaluate the nutritional, social, and psychological status of older adults in nursing homes and freely living. This is of particular importance as the number and percentage of older adults in Syria and the Arab world is on the rise. Thus more health and nutrition care are needed.
- Awareness should be raised at the national level about the importance of healthy nutrition including drinking the recommended amount of fluids.
- Awareness about healthy nutrition and regular exercise should start at an early age and throughout life to enjoy a healthy aging. Prevention is better than care still holds very true.

Limitations

This study may have some limitation due to the self-reported data collected in the MNA. The generalization of the findings of this study may be also limited due to small sample size and the fact that all older adults living in nursing homes were recruited from private nursing homes which may indicate that they come from high socioeconomic status.

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Appendix1

GRADING THE NUTRITIONAL STATE OF ELDERLY PATIENTS

MINI NUTRITIONAL ASSESSMENT
MNA®

ID# ____________

Last Name: ____________ First Name: ____________ M.I. ____ Sex: ____ Date: ____________

Age: ____ Weight, kg: ________ Height, cm: ________ Knee Height, cm: ________

Complete the form by writing the numbers in the boxes. Add the numbers in the boxes and compare the total assessment to the Malnutrition Indicator Score.

ANTHROPOMETRIC ASSESSMENT

	Points
1. Body Mass Index (BMI) (weight in kg) / (height in m)^2 a. BMI < 19 = 0 points b. BMI 19 to < 21 = 1 point c. BMI 21 to < 23 = 2 points d. BMI ≥ 23 = 3 points	☐
2. Mid-arm circumference (MAC) in cm a. MAC < 21 = 0.0 points b. MAC 21 ≤ 22 = 0.5 points c. MAC > 22 = 1.0 points	☐.☐
3. Calf circumference (CC) in cm a. CC < 31 = 0 points b. CC ≥ 31 = 1 point	☐
4. Weight loss during last 3 months a. weight loss greater than 3kg (6.6 lbs) = 0 points b. does not know = 1 point c. weight loss between 1 and 3 kg (2.2 and 6.6 lbs) = 2 points d. no weight loss = 3 points	☐

GENERAL ASSESSMENT

5. Lives independently (not in a nursing home or hospital) a. no = 0 points b. yes = 1 point	☐
6. Takes more than 3 prescription drugs per day a. yes = 0 points b. no = 1 point	☐
7. Has suffered psychological stress or acute disease in the past 3 months a. yes = 0 points b. no = 2 points	☐
8. Mobility a. bed or chair bound = 0 points b. able to get out of bed/chair but does not go out = 1 point c. goes out = 2 points	☐
9. Neuropsychological problems a. severe dementia or depression = 0 points b. mild dementia = 1 point c. no psychological problems = 2 points	☐
10. Pressure sores or skin ulcers a. yes = 0 points b. no = 1 point	☐

DIETARY ASSESSMENT

	Points
11. How many full meals does the patient eat daily? a. 1 meal = 0 points b. 2 meals = 1 point c. 3 meals = 2 points	☐
12. Selected comsumption markers for protein intake • At least one serving of dairy products (milk, cheese, yogurt) per day? yes ☐ no ☐ • Two or more servings of legumes or eggs per week? yes ☐ no ☐ • Meat, fish or poultry every day? yes ☐ no ☐ a. if 0 or 1 yes = 0.0 points b. if 2 yes = 0.5 points c. if 3 yes = 1.0 points	☐.☐
13. Consumes two or more servings of fruits or vegetables per day? a. no = 0 points b. yes = 1 point	☐
14. Has food intake declined over the past three months due to loss of appetite, digestive problems, chewing or swallowing difficulties? a. severe loss of appetite = 0 points b. moderate loss of appetite = 1 point c. no loss of appetite = 2 points	☐
15. How much fluid (water, juice, coffee, tea, milk,...) is consumed per day? (1 cup = 8 oz.) a. less than 3 cups = 0.0 points b. 3 to 5 cups = 0.5 points c. more than 5 cups = 1.0 points	☐.☐
16. Mode of feeding a. Unable to eat without assistance = 0 points b. self-fed with some difficulty = 1 point c. self-fed without any problem = 2 points	☐

SELF ASSESSMENT

17. Do they view themselves as having nutritional problems? a. major malnutrition = 0 points b. does not know or moderate malnutrition = 1 point c. no nutritional problem = 2 points	☐
18. In comparison with other people of the same age, how do they consider their health status? a. not as good = 0.0 points b. does not know = 0.5 points c. as good = 1.0 points d. better = 2.0 points	☐.☐

ASSESSMENT TOTAL (max. 30 points): ☐☐.☐

MALNUTRITION INDICATOR SCORE

≥ 24 points	well-nourished	☐
17 to 23.5 points	at risk of malnutrition	☐
< 17 points	malnourished	☐

Ref.: Guigoz Y, Vellas B and Garry PJ. 1994. Mini Nutritional Assessment: A practical assessment tool for grading the nutritional state of elderly patients. *Facts and Research in Gerontology.* Supplement #2: 15-59.

Appendix 2

The major features of the Modified MyPyramid for Older Adults graphic that are different from MyPyramid are the expanded presentation of food icons throughout the pyramid highlighting good choices within each category, a foundation depicting a row of water glasses and physical activities emphasizing the **increased importance of both fluid intake and regular physical activity** in older adults, and a flag on the top to suggest that some older adults, due to biological changes, may **need supplemental vitamins B-12 and D, and calcium.**

Barclay,L.(2008), MyPyramid dietary guidelines modified for older adults. Journal of nutrition, 138:5-11.

Modified MyPyramid for Older Adults



مقارنة الحالة التغذوية لمجموعة من المسنين في دور العناية مع مجموعة اخرى يعيشون في منازلهم في دمشق

اعداد

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المشرف

الأستاذ الدكتور أحمد محمود الفقيه

الملخص

أجريت هذه الدراسة لمقارنة الحالة التغذوية لمجموعة من المسنين الذين تتراوح أعمارهم بين 60-85 عاما في دور العناية مع مجموعة أخرى يعيشون في منازلهم في دمشق. تم تقييم الوضع التغذوي لمائة مسن باستخدام قياسات الجسم البشري ، وبعض التحاليل الكيميائية الحيوية ، واستبيان لتقييم الوضع التغذوي على نطاق محدود لتقييم الوضع التغذوي حيث تم تقسيم المسنين إلى مجموعتين: تكونت المجموعة الأولى من خمسين مسن من دور المسنين و المجموعة الثانية مكونة من خمسين مسن يعيشون في منازلهم بنسب متساوية بين الذكور والإناث في كلتا المجموعتين.

أظهر تقييم وزن الجسم حسب مؤشر كتلة الجسم فرقا معنويا في نسبة الأشخاص ناقصي الوزن في دور المسنين (6 ٪) عند مقارنتهم بالمسنين الذين يسكنون في منازلهم (2%) (P <0.05)، كما لوحظ نمط مماثل ولكن دون فروق معنوية لنسبة الوزن الزائد عند الأشخاص في دور المسنين بالمقارنة مع الأشخاص في منازلهم (48%) و (36%) على التوالي. أما نسبة البدانة فقد كان هناك ارتفاع معنوي عند الأشخاص الذين يقيمون في منازلهم عند مقارنتهم بالمقيمين في دور المسنين حيث كانت النسب 48% و28% على التوالي (P <0.05).

لم يتم الكشف عن نقص في فيتامين ب12(ب12<150بيكوغرام/دل) عند الأشخاص في دور المسنين مقارنة مع معدل الانتشار 16% عند الأشخاص في منازلهم (P<0.05)، بينما لم يتم الكشف عن نقص الألبومين في الدم عند الأشخاص في منازلهم مقارنة مع معدل انتشار منخفض 8% عند الأشخاص في دور المسنين.

عند فحص سكر الدم بعد الصيام تبين ارتفاع معدل انتشار السكري عند الأشخاص في دور المسنين مقارنة مع الأشخاص في منازلهم 28% و18%، على التوالي، بينما تبين أن 30% من الأشخاص في منازلهم يعانون من ممانعة الانسولين(ما قبل السكري) مقارنة مع 18% من الأشخاص في دور المسنين.

كان هناك ارتفاع معنوي ملحوظ لنسبة الأشخاص في منازلهم والذين يعانون من ارتفاع في مستويات الكولسترول الكلي (أكثر من 240مغ/دل) حيث وصلت نسبتهم إلى 24% عند مقارنتهم بالمقيمين في دور المسنين إذ لم تتجاوز نسبتهم 12% (P<0,05). وقد لوحظ وجود نسبة 32% من

المقيمين في منازلهم يعانون من الارتفاع المفرط للكوليسترول الكلي (الحد الأعلى لمستوى الكوليسترول الكلي (200-239 مغ/دل)) بينما كانت انخفضت انخفاضا معنويا إلى 20% عند المقيمين في دور المسنين($P<0,05$).

تبين وجود ارتفاع معنوي في مستويات الدهون الثلاثية عند الأشخاص المقيمين في منازلهم (أكثر من 150مغ/دل) عند مقارنتهم بالمقيمين في دور المسنين حيث كانت النسب 46% و34% ،على التوالي ($p<0,05$). كما كان هناك ارتفاع معنوي مماثل لنسبة الأشخاص المقيمين في منازلهم والذين وصلت الدهون الثلاثية لديهم إلى الحد الأعلى (150-199 مغ/دل) بنسبة30% مقارنة مع معدل انتشار 20% في دور المسنين.($P<0,05$). فيما تمتع تقريبا نصف المسنين في الدور بمستوى طبيعي من الشحوم الثلاثية (أقل من 150 مغ/دل) مقارنة مع ربع العدد عند المقيمين في منازلهم ($P<0,05$). كما تمتع أكثر من ثلثي المسنين في الدور بمستوى طبيعي من الكوليسترول الكلي(أقل من 200 مغ /دل) بشكل ملحوظ ($P<0,05$).

بالنسبة لفقر الدم كما هو موضح حسب مستوى هيموغلوبين في الدم (الذكور اقل من 14 مغ والإناث أقل من 12 مغ) تبين ارتفاع أن هناك ارتفاعا معنويا عند المقيمين في دور المسنين بنسبة 16% مقارنة مع عند المسنين في منازلهم (6%)($P<0,05$).

كانت نسبة المسنين المقيمين في منازلهم والذين يشربون السوائل يوميا بمعدل أكثر من خمسة أكواب وأقل من ثمانية مرتفعة معنويا حيث وصلت الى 64% مقارنة بنسبة 36% للمسنين المقيمين في دور المسنين.

بالرجوع الى استبيان تقييم الوضع التغذوي على نطاق محدود (MNA) تبين أن نسبة المسنين الذين تقدم لهم العناية التغذوية بشكل جيد كانت قليلة جدا في دور المسنين حيث وصلت الى 6% مقارنة بالمقيمين في منازلهم حيث وجدوا رعاية تغذوية كاملة وصلت إلى 100% ($P<0.05$). بالاضافة إلى أن ما نسبته 92% من المسنين المقيمين في دور الرعاية معرضون للوصول إلى سوء التغذية، وتم تقييم حالة سوء تغذية واحدة منهم($P<0,05$). كما كانت هناك ارتفاعا معنويا في نسبة الذين يعانون من الضغط النفسي في دور الرعاية بنسبة وصلت إلى 96% مقارنة بنسبة 6% للمقيمين في منازلهم.

أظهرت الدراسة الحالية أن المسنين المقيمين في دور الرعاية معرضون للإصابة بسوء التغذية حسب استبيان تقييم الوضع التغذوي على نطاق محدود، كما ثبت وجود نسبة مرتفعة من الاصابة بالضغوط النفسية عند أغلبية المقيمين في دور الرعاية. بينما كان هناك ضبط ملحوظ لوزن الجسم والكوليسترول الكلي والدهون الثلاثية وفيتامين ب12ضمن الحدود الطبيعية عند مقارنتهم بالمقيمين في منازلهم. وقد كانت نسبة تناول السوائل غير كافية لدى المجموعتين.